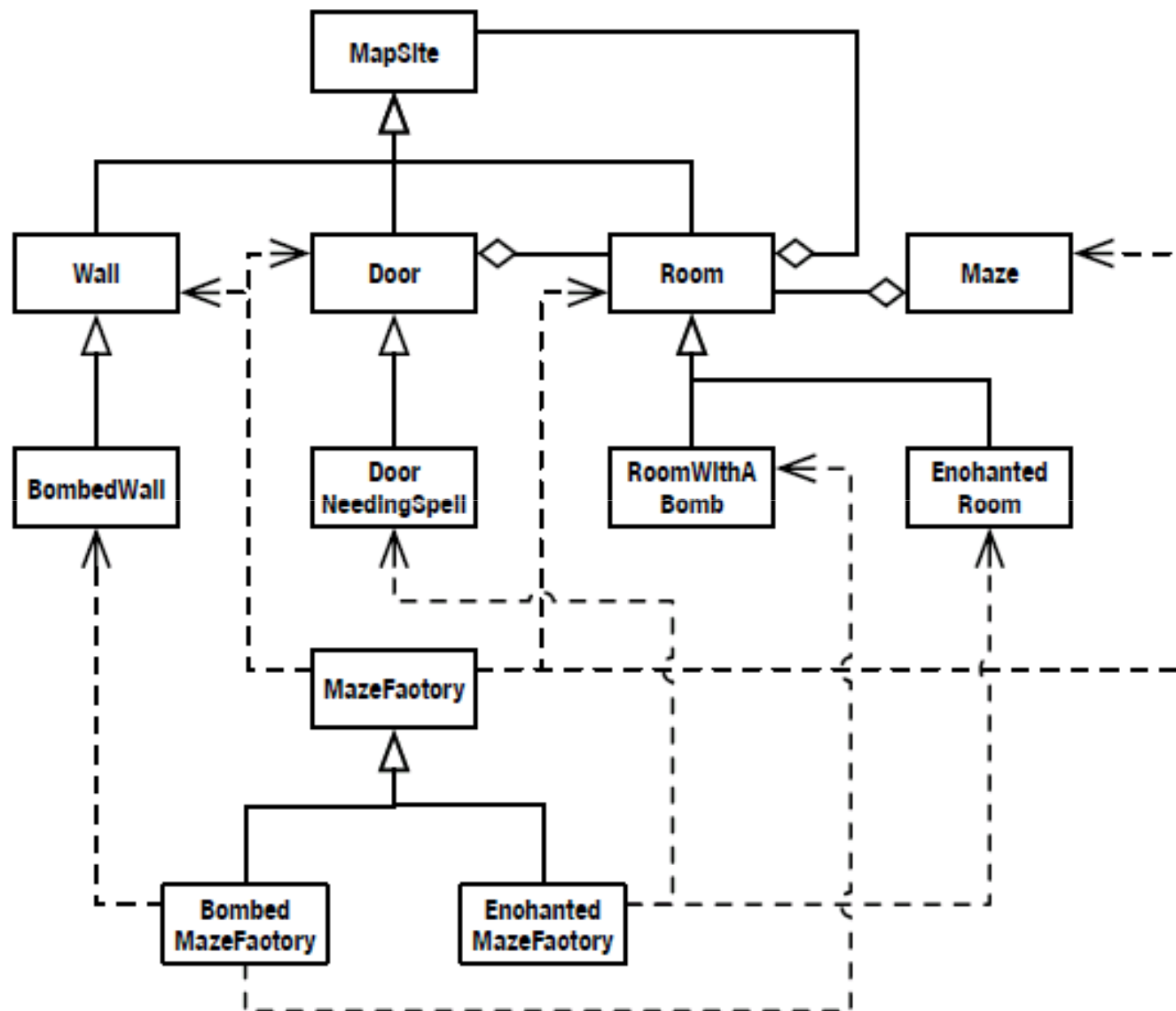


# **Measuring Software Design Modularity**

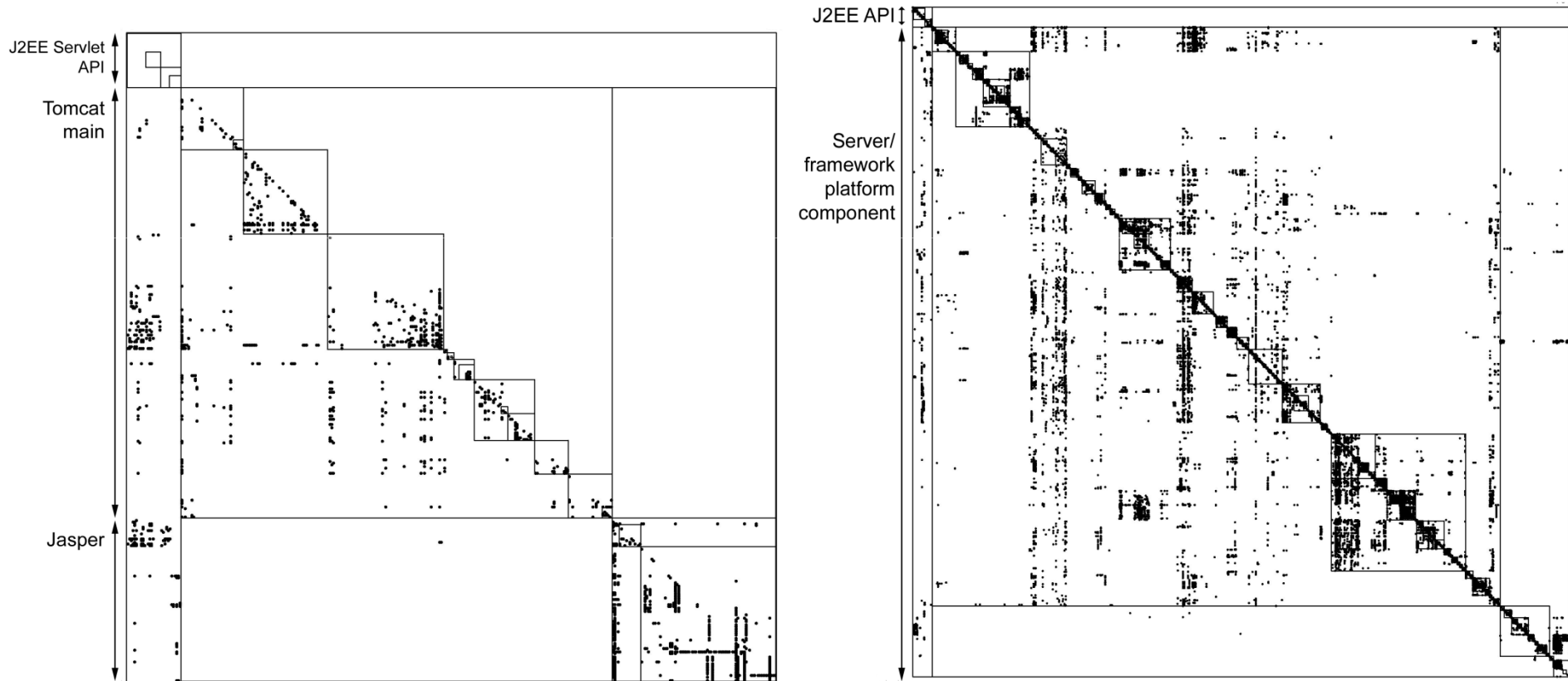
Yuanfang Cai, Sunny Huynh  
Drexel University

# What is a *Module*?

- The definition is fundamental to measurement
- Commonly used definitions
- Parnas's definition
  
- Commonly used metrics
- The discrepancies
  
- The need of suitable representation
  - To identify modules
  - To identify interfaces



# Design Structure Matrix at the level of source code





# Issues

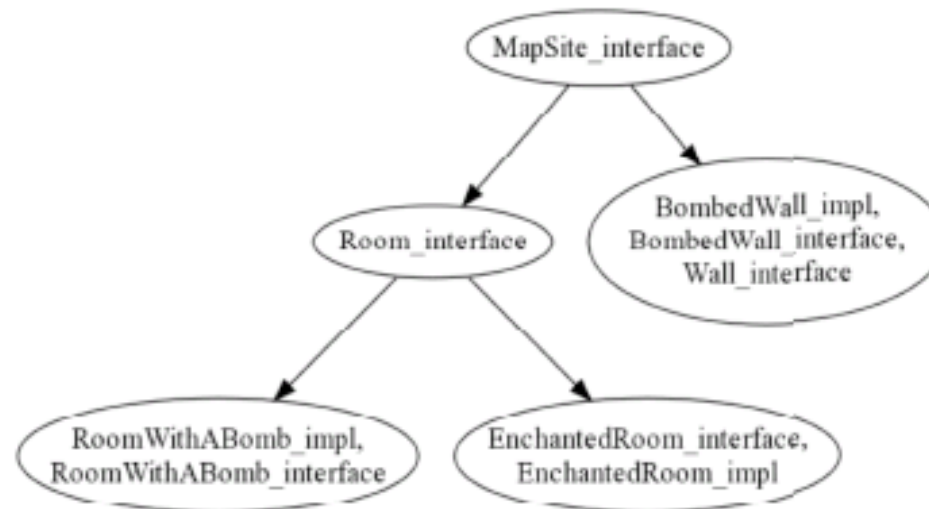
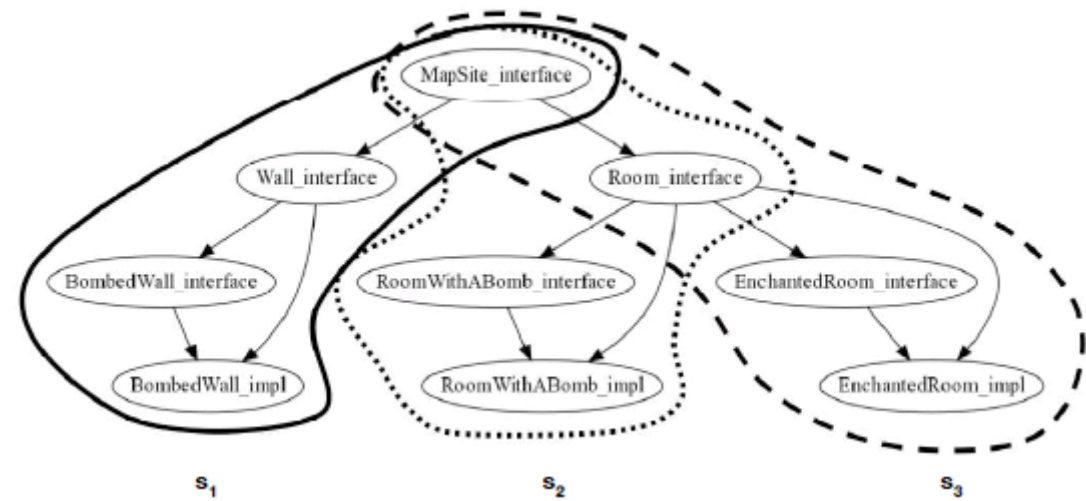
- Clustering source code DSM according to package is not sufficient
  - What if the source code is not available
  - We need to assign tasks before coding
- At design level, however, how to cluster a DSM into modules is not obvious
  - That is what we have automated
    - Transform a design model into logic model and then to DSM
    - Automatic Design rule hierarchy clustering
  - How to select the set of variables



```

1. MapSite_interface : {orig, other};
2. MapSite_impl : {orig, other};
3. Room_interface : {orig, other};
4. Room_impl : {orig, other};
5. Maze_interface : {orig, other};
6. Maze_impl : {orig, other};
7. Room_impl = orig =>
   MapSite_interface = orig;
8. Room_impl = orig =>
   MapSite_impl = orig;
9. Maze_impl = orig =>
   Room_interface = orig;
10. (MapSite_impl, MapSite_interface);
11. (Room_impl, Room_interface);
12. (Room_interface, MapSite_interface);

```



# Metrics

- Aspects to consider
  - The number of modules
  - The sizes of each module
  - A module can't be too large and can't be too small
  - How likely a module will change
  - How other modules depend on the module
- Net Option Value Analysis

$$NOV_i = \max_{k_i} \{ \sigma_i n_i^{1/2} Q(k_i) - C_i(n_i) k_i - Z_i \}$$

$$V = S_0 + NOV_1 + NOV_2 + \dots + NOV_n$$

# A New Metric: The Level of Independence (LI)

- A Simplified Metric consistent with NOV
  - Maze Game: 46%
- Comparative Analysis
  - KWIC:
    - Information Hiding: 60%
    - Sequential: 44%
- Better be with a DSM